DOCUMENT RESUME

ED 465 733 SP 040 885

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TITLE	Authentic Teaching of Fitness Concepts to Children.
PUB DATE	2002-00-00
NOTE	16p.; Paper presented at the Annual Meeting of the American Association for Health, Physical Education, Recreation and Dance (San Diego, CA, April 9-13, 2002). Contains small print.
PUB TYPE	Guides - Non-Classroom (055) -- Speeches/Meeting Papers (150)
EDRS PRICE	MF01/PC01 Plus Postage.
DESCRIPTORS	Aerobics; *Cardiovascular System; Elementary Education; Elementary School Students; *Muscular System; *Physical Education; *Physical Fitness
IDENTIFIERS	*Strength Training

ABSTRACT

This paper stresses the importance of teaching aerobic and muscle fitness concepts as part of a health-related fitness curriculum in physical education, recommending outcomes for teaching aerobic endurance and muscle/strength endurance in kindergarten through sixth grade. It describes important learning aid materials and presents national standards and benchmarks for application to aerobic and muscle fitness. The paper presents authentic teaching of aerobic endurance concepts to children in grades K-2 (e.g., location, size, and purpose of heart and resting and exercise pulse) and children in grades 3-6 (e.g., defining aerobic endurance and recording heart rate), offering related learning activities. It also presents authentic teaching of muscle fitness concepts to children in grades K-2 (e.g., the purpose of muscles and correct exercise performance using one's own body weight) and children in grades 3-6 (e.g., major muscles and muscular strength/endurance definition and importance), offering appropriate learning activities. (Contains references.) (SM)

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Authentic Teaching of Fitness Concepts to Children

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INTRODUCTION TO:

Authentic Teaching of Fitness Concepts to Children

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Aerobic and muscle fitness concepts are an important part of any health-related fitness curriculum in physical education and an important part of the National Standards for Physical Education (NASPE, 1995). Table 1 identifies the NASPE standards and benchmarks that can be achieved through the teaching of these fitness concepts.

Several professional sources have identified specific aerobic endurance and muscle strength/endurance information that is appropriate to teach children in elementary physical education classes (AAHPERD, 1999; Sander & Ratliffe, 2001; Ratliffe, 2000; Ratliffe & Ratliffe,1994; Virgilio, 1997).

The following outcomes are suggested for teaching aerobic endurance in kindergarten through sixth grade.

At the primary level (K-2), students should be able to:
1. Identify location, size, and function of the heart.
2. Identify parts and function of the circulatory and respiratory systems.
3. Identify where to find the heart beat.
4. Identify the effects of rest and exercise on the heart.
5. Identify activities and habits that don't help the heart.
6. Perform activities that do help the heart -- healthy heart activities.
7. Understand how to measure a strong heart (endurance challenges including the PACER, the one mile run/walk or nine minute run/walk).

At the Intermediate level (3-6), students should be able to:
1. Demonstrate the primary level concepts.
2. Identify the meaning of cardiorespiratory endurance and aerobics
3. Identify the definition of endurance.
4. Participate in regular aerobic endurance activities.
5. Identify the benefits of high levels of cardiorespiratory endurance.
6. Identify how the heart, lungs, vascular system, and respiratory system respond to exercise.
7. Identify the role of oxygen in producing energy.
8. Demonstrate the ability to count the pulse and calculate heart rate.
9. Evaluate the contribution of a variety of physical activities to cardiorespiratory fitness.
10. Identify the risk factors of heart disease and ways to modify the risk factors.
11. Identify how to measure cardiorespiratory fitness and the purpose of the endurance tests (one mile and nine minute run/walk).

For teaching muscle strength/endurance in kindergarten through the sixth grade, the subsequent outcomes are suggested:

At the primary level (K-2), students should be able to:
1. Identify that the body has many muscles and that they need physical activity to be strong.
2. Identify the purpose of muscles.
3. Demonstrate the correct procedures for lifting objects.
4. Perform activities and exercises to achieve strong muscles.
5. Identify and practice appropriate exercises and activities for specific groups of muscles, and
6. Learn to correctly perform exercises using their own body weight as resistance

At the Intermediate level (3-6), students should be able to:

1. Demonstrate the primary level concepts.
2. Identify and locate major muscles.
3. Identify the meaning and importance of muscular strength and endurance.
4. Demonstrate correct technique to perform muscular strength and endurance exercises and activities using body weight as resistance and resistance equipment (exercise bands, light weights).
5. Identify and practice appropriate exercises and activities for specific groups of muscles.
6. Describe and demonstrate how to apply the principle of overload by using repetitions and sets.
7. Identify and apply the FITT formula -- frequency, intensity, time, and type -- to safely apply the principles of overload and progression
8. Identify how to measure muscular strength and endurance.

(**Note:** Warm-up of course is a crucial component of aerobic and muscle fitness but is not in the scope of this particular paper.)

Learning Aid Materials. When planning what to teach children, of equal importance is how to teach these concepts. Helping children understand fitness concepts can be accomplished by presenting concrete examples and applications of the concepts. Sander and Burton (1989) urged the use of visual aids, objects, and events (learning aid materials) to introduce concepts and help children comprehend cognitive information. Their premise emphasized that verbal information alone does not adequately foster conceptual understanding. Thus, **visual aids** (pictures, posters, drawings, charts, task cards, transparencies, books, magazines, newspapers, CD-ROMs, the Internet, video tapes, slides), **objects** (i.e., stethoscope, heart rate monitor, heart model, bicycle pump) and **events** (action-oriented demonstrations) provide a variety of effective and enjoyable ways to present the information. **Combining different modes of learning** (verbal information combined with visual or event type learning) can significantly increase information recall. However, time constraints within typical 30-minute classes do present a challenge for efficient delivery, so as not to significantly reduce actual physical activity time for children. **Therefore, well-planned episodes of one to five minutes can be used as a forum to present fitness information. The learning aid ideas later presented in this document should be used with lesson tasks involving physical activity.**

Table 1. National Standards and Benchmarks for Application to Aerobic and Muscle Fitness.

Standard Two: Applies movement concepts and principles to the learning and development of motor skills.

- Identifies basic practice and conditioning principles that enhance performance.

Standard Three: Exhibits a physically active lifestyle.

- Recognizes that physical activity is good for personal well-being.
- Willingly completes physical education activity homework assignments.
- Describes healthful benefits that result from regular and appropriate participation in physical activity, and
- Identifies opportunities close to home for participation in different kinds of activities.

Standard Four: Achieves and maintains a health-enhancing level of physical fitness.

- Identifies changes in the body during vigorous physical activity.
- Is aware of his/her heart beating fast during physical activity*,
- Keeps a record of heart rate before, during, and after vigorous physical activity*, and
- Correctly demonstrates activities designed to improve and maintain muscular strength and endurance, flexibility, cardiorespiratory functioning, and proper body composition.

* (Denotes a benchmark related only to aerobic fitness)

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Authentic Teaching of Fitness Concepts to Children: Aerobic Endurance Concepts

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Grades K-2

1. **Location, Size, and Purpose of the Heart.** The heart is a muscle about the size of a fist, just to the left of the middle of the chest. Its purpose is to pump blood [which carries air (oxygen)] to all body parts.
Learning Idea (visual aid/object): An American Heart Association poster of the heart and blood vessels in the body is presented to students. Heart size and location are then demonstrated by placing a fist in the middle of the chest. It is explained that the heart is a muscle which acts like a pump. The teacher squeezes water several times from a sport water bottle to depict this. (The teacher can also squeeze a small balloon in one hand to show how blood is pumped from the heart). A check for understanding then occurs with all students demonstrating size/location of the heart followed by a question about its purpose. The students can color a picture of the heart as homework or in the classroom. Materials included in the American Heart Association Heart Power Kit or Florida's Fit to Achieve Program offer good resource pictures.

2. **Location, Size, and Purpose of the Lungs.** The lungs are two pink air sacs to the left and right side of the heart. They take in air (oxygen) that the blood then takes to all body parts; they also get rid of air (carbon dioxide) that the body has used.
Learning Idea (visual aid/object): An American Heart Association poster of the lungs in the body is presented to students. Lung location is then demonstrated by placing the hands on the upper left and right side of the chest. A small beach ball or balloon is used to display how the lungs take in and release air. A check for understanding occurs with all students demonstrating the location of the lungs followed by a question about their purpose. The students can color a picture of the lungs as homework or in the classroom; materials included in the American Heart Association Heart Power Kit offer a good resource.

3. **The Resting Pulse (Heart Beat).** A heart beat is when blood is pumped from the heart to all body parts. Finding a heart beat is done by listening with a stethoscope placed just to the left of the middle of the chest. A heart beat can also be felt under the wrist or at the side of the neck and is called a pulse. Two fingers are placed lightly on the side of the neck without crossing the throat. It can also be observed on a heart rate monitor.
Learning Idea (object/event): Students first listen to about 10 seconds of an audiotape of recorded heart beats. An explanation follows that it is the sound of the heart beating so it can pump blood to the body. Then, after a teacher demonstration, they feel their own resting carotid pulse by placing two fingers lightly on the side of their neck (A heart rate monitor on the teacher will reinforce the hearts beating action.) A check for understanding occurs with selected students being asked questions about where/how to take pulse. (An opportunity to listen to their own heart with a stethoscope and/or observe their own pulse on a heart rate monitor is integrated into the lesson at a learning station. Further opportunities to listen to the heart beat can be made available in the classroom.)

4. . **The Exercise Pulse (Heart Beat).** This heart beat is when blood is pumped faster from the heart to all body parts. The heart works harder to pump blood faster. Immediately after an exercise bout, the exercise pulse can be listened to with a stethoscope, felt under the wrist/side of the neck with two fingers, or observed on a heart rate monitor.
Learning Idea (object/event): Students are reminded about the resting heart rate and how to hear it with a stethoscope, feel it at the neck, and observe it on heart rate monitor. Students are then told that blood is pumped faster from the heart to all body parts during exercise; also that the heart works harder to pump blood faster. Students then are asked to jump for 30 seconds followed by having them feel their own carotid pulse by placing two fingers lightly on the side of their neck. A check for understanding occurs by asking selected students questions about where/how to take an exercise pulse. (An opportunity to become more aware of their own exercise heart beat can be integrated into the lesson at a learning station with a stethoscope and/or observing their own pulse on a heart rate monitor. Further opportunities are provided in the classroom.)

5. **Respiration Rate.** Respiration (breathing) is the continued taking in and giving out of air (oxygen and carbon dioxide) by the lungs. A check on breathing rate is done by crossing the arms on the chest during rest and immediately after exercise. Like the heart, lungs work harder during exercise than at rest causing the chest to move at a faster rate.
Learning Idea (event): Students are given a brief opportunity to view their own resting breathing rates while having them cross their arms on their own chest; this is repeated after jumping fast in place for 10 seconds. A check for understanding occurs by asking selected students why the crossed arms/chest move faster after exercise.

6. **Specificity Principle: Activities that Help Heart/Lungs Get Stronger (Gain Endurance).** Healthy heart/lung activities are called aerobic activities and include walking biking, skating, running, swimming, and also running in sports such as basketball and soccer. These activities make the heart work hard (by pumping blood faster) for a long period of time.
Learning Idea (visual aid): Students are shown different sport or fitness magazine pictures (taped on posters) of the above activities to reinforce what physical activities make strong heart and lungs. It is emphasized that these healthy heart activities make the heart work hard for a long period of time. A check for understanding simply may involve children recalling the pictures. (In the classroom or as homework students can create a collage of these activities using pic.ures from sport/fitness magazines or newspapers.)

7. **Benefits of a Strong Heart/Lungs**. The heart is a muscle and gets stronger by doing healthy heart/lung (aerobic) activities so they can easily work hard without getting too tired during work or play. This means the heart does not have to beat as much, the lungs don't have to breathe in/out so fast, and we don't get tired too easily. Healthy heart/lungs make you feel good, look good, and have more fun in exercise and sports.
Learning Idea (visual aid/object): Students are told that a heart gets strong through a lot of healthy physical activity. A strong heart does not get tired too quickly when it works hard because it beats less often. The lungs also take air in/out better. Students are then shown a drawing of a smiling heart/lungs on a human stick figure that is running down hill with the words "feel good, look good, have fun." They are also shown a stick figure drawing of a frowning/puffing/sweating heart/lungs that is struggling to run uphill. As a check for understanding, selected students are then asked what they remember about a healthy heart/lungs.

8. **Activities to Measure a Strong Heart/Lungs (Aerobic Endurance).** Activities that will help measure heart/lung endurance include distance runs such as the half mile or mile. These activities require people to pace themselves by not moving too fast so they will not have to stop before finishing the activity.
Learning Ideas (event): Students are reminded of the many activities that help develop healthy heart/lungs. Students are told today's fun activity will be running laps which will make the heart work hard for a long period of time. Students are first taught about pacing while jogging (and walking if needed) with an emphasis on not stopping and not competing with another student. Students are given a choice of levels, walking, jogging, and running to use when moving around a lap of a quarter mile at a comfortable pace. To check for understanding when the aerobic activity is completed, selected students are asked to explain about pacing/walking, and what activities are used to measure the strength and endurance of the heart/lungs.

Grades 3-6

1. **Review K-2 Concepts**

2. **Definition of Aerobic Endurance (Heart/Lung Endurance).** Aerobic endurance is the ability of the heart and lungs to work hard for a long time without getting too tired (providing as much oxygen as needed by the muscles to work for a long time).
Learning Ideas (event/object): Students are asked to slowly jump sideways back and forth over a bean bag until they are too tired to continue. It is mentioned that the longer one can jump without stopping, the greater the heart/lung endurance (aerobic endurance). As a check for understanding, a selected student may be asked to state the term for being able to jump or run for a long time without getting too tired. (An inexpensive spirometer with plastic or cardboard mouthpieces from a health/fitness catalog offers a fun experience at a learning station or in the classroom to observe lung exhalation capacity.)

3. **Heart Disease Risk Factors.** A few factors that increase the risk of heart problems include smoking, inactivity, and eating too much fatty food (fried foods and meats).
Learning Ideas (visual aid): Students are shown a poster with an X across each picture of a person smoking, a person watching TV, and a person eating French fries. The teacher states that a) smoking hurts the heart/lungs; b) that doing healthy heart activity (aerobic activity) is important to develop a healthy heart/lungs in contrast to not doing aerobic activities; and c) too much fast food is bad while vegetables and fruits are better. To check understanding, students are asked what they can do to help prevent heart problems. (An American Heart Association videotape on risk factors included in the Heart Power kit can later be viewed in physical education or the classroom to emphasize eliminating unhealthy habits.)

4. **Circulatory/Respiratory System Process**. Blood is pumped from the heart to the lungs (through the pulmonary artery) to pick up fresh air (oxygen) and then pumped (via pulmonary vein) back to the heart. The heart then pumps the oxygen-rich blood (through arteries) to all body parts including muscles. At the body parts, capillaries carry the oxygen to the cells and also remove carbon dioxide from the cells. The blood is then transported through veins back to the heart, carrying carbon dioxide which will be expelled by the lungs.
Learning Ideas (visual aid/event/objects): An American Heart Association or other available poster of the circulatory system is first shown to children. Several objects are then placed in a formation on a softball infield as follows: two blue and two red game cones depict the heart when placed in a 10' X 10' square between pitcher's mound and second base. Two adjacent red hoops acting as lungs are placed at second base. A blue rope on the ground between the heart and lungs represents the pulmonary artery and a red rope represents the pulmonary vein. Two carpet squares act as a body cell at home plate. One red carpet square allows for the entrance of blood carrying oxygen while one blue carpet square permits the exit of blood carrying carbon dioxide. Poly spots are used as blood vessels and are spread out in a large oval pathway away from both sides of the heart to meet the carpet square area at home plate. To start the learning activity, students are shown the pathway for walking and are spread out on the poly spots. As the teacher beats a drum slowly for a resting heart beat, students walk slowly in a clockwise pathway without passing anyone. (This represents blood flow of a resting heart.) Students will enter one side of the heart (two blue cones), then travel along the blue rope to the lungs (red hoops) where they exhale carbon dioxide and inhale oxygen. They will return via the red rope to the other side of the heart (two orange cones) and travel along the poly spot pathway to the body cell. Students will follow the other poly spot pathway to return to the blue cone side of the heart. A check for understanding may occur by asking selected students what the heart does with the blood, what happens in the lungs, and what happens in body cells. (To extend this experience further, blue and red plastic golf balls can be available in boxes at the lungs and body cell so children can drop off carbon dioxide and carry oxygen through the blood stream.)

5. **Benefits of Aerobic Endurance.** The heart muscle and the lungs get stronger by doing healthy heart/lung (aerobic) activities so they do not have to work as hard during work or play. This means the heart does not have to beat as often and also doesn't have to work as hard to pump blood. Therefore, blood pressure is lower, cholesterol is lower in the blood vessels, and there are fewer heart beats per minute during rest and exercise. A stronger heart helps to lower the risk of heart disease. Also the lungs can take in more oxygen and don't tire so easily. Healthy heart/lungs make you feel good, look good, and have more fun in exercise and sports.
Learning Idea (visual aid/event/object): One student is selected to push down and pull up on a bicycle pump (which is like the heart pumping blood) until he/she gets tired. Students are told that a healthy heart and lungs do not get tired too quickly when they work hard because they are stronger. They are also told that a healthy heart beats less often, and healthy lungs can take in more air. (The importance of lower blood pressure and cholesterol may also be mentioned.) Lastly, students are told that they will "feel better and look good" by having good aerobic endurance. To check for understanding, selected students are asked that if a person has aerobic endurance, what are the benefits to the heart, to the lungs, and how he/she will look and feel. (A simple digital blood pressure cuff for the wrist or finger is available from several physical education catalogs. Students can use it with teacher supervision to observe their blood pressure at a learning station or in the classroom.)

6. **Recording Heart Rate (Pulse).** The pulse is a way of counting heart beats at the wrist with a heart rate monitor, placing two fingers lightly on the side of the neck, or counting the beats over the heart using a stethoscope. The pulse is counted for six seconds and a '0' is added to the number to equate with one full minute. (A 10 second count followed by multiplying by six may be substituted.) The resting pulse (Resting

Heart Rate) is preferably taken sitting down; exercise heart rate is taken with a pulse monitor during exercise or immediately after exercise and counting the beats on the side of the neck.
Learning Idea (object/event): After a teacher demonstration, students sit and count their own resting carotid pulse for six seconds, then add a 0 to the number on a card. Similarly they jump fast in place for 30 seconds, count the pulse for six seconds, and record it on a card adding a 0. A check for understanding occurs with selected students being asked questions about where/how to take and record the pulse. At a learning station or in the classroom, heart rate monitors and stethoscopes may be used to count the pulse.

7. **Frequency Guideline for Aerobic Endurance.** Frequency (F) means how often (or how many days a week) that one participates in aerobic activity. To improve heart/lung endurance (aerobic endurance), one should take part in aerobic activities daily (but at least three days each week).
Learning Idea (visual aid): A large desk calendar is shown that has each day of the week checked-off for aerobic exercise. A definition about frequency should follow with encouragement to participate in aerobic activity everyday (but at least three days each week). A check for understanding involves asking selected students to give examples of the aerobic activities in which they participate each day of the week.

8. **Intensity Guideline for Aerobic Endurance (Target Heart Rate Zone).** Intensity (I) means how hard the heart works (the number of heart beats) during aerobic activity. To improve aerobic endurance, the heart has to beat at a medium to high level. This means it must beat fast enough to be within the Target Heart Rate Zone (THRZ). An accurate THRZ method involves using formulas such as the Karvonen formula which considers one's age and resting heart rate (RHR) to find the lower limit of the zone [(220-age) - RHR x .60 + RHR] and upper limit of the zone [(220-age) - RHR x .80+RHR]. Of course people might start an exercise program below the target heart rate zone based on comfort level. The intensity focus is on activities that cause the heart to beat at moderate and high levels.
Learning Idea (visual aid/event): Students are told of the importance of having the heart beat fast enough so that it will work "hard enough" pumping blood to become strong. Students are shown pictures of a person watching TV with the words "low heart beats;" another mowing a lawn with the words "medium heart beats;" and also someone playing soccer with the words "high heart beats;" Children are then asked examples of activities relating to the heart rate levels. As a follow-up in another physical education class session, children sit and find their RHR, counting the carotid pulse for six seconds (and adding a 0). A THRZ chart is then displayed showing highlighted heart rate zones for 9-12 year olds to have during physical activity (based on a RHR of 70, 80, and 90). It is explained that the RHR will be well below the THRZ. Because of RHR and age, it is also explained that everyone's zone can be slightly different. For practice, students then do jumping jacks or jog in place for a minute followed by a six second carotid pulse count (and adding a 0). (Heart monitors may also be used.) Students then compare their exercise heart rate to the THRZ based on the closest RHR of 70, 80, or 90. (The formula for THRZ can later be done at a learning station, in the classroom, or as homework to find their exact THRZ). A check for understanding may involve asking selected students to evaluate if sample exercise heart rates fall in the THRZ. (A commercial THRZ poster such as the one from Polar can also be placed on a physical education bulletin board to stimulate weekly observation and understanding.)

9. **Time Guideline for Aerobic Endurance.** Time (T) means how long the heart needs to work hard during aerobic activity. To improve heart and lung endurance (aerobic endurance), children need to engage in moderate to vigorous physical activity by accumulating at least 60 minutes of physical activity a day (at least 20 minutes for adolescents/adults) while being in the THRZ. Of course, people might start an exercise program below the 60 or more minute guideline based on comfort level. (Current research promotes moderate to vigorous, intermittent activities to accumulate to 60 or more minutes during each day for children.)
Learning Idea (visual aid or object): After explaining the time guideline, the teacher displays a real or cardboard clock with moveable hands. Students are told that Billy played tag for 10 minutes before school (as the long clock hand is moved 10 minutes); he also climbed playground equipment at recess for 10 minutes (as the long clock hand is moved 10 minutes more); rode a bike to a friend's house and back home for 20 minutes after school (as the long hand is moved 20 minutes more); and even practiced shooting basketballs with a parent for 20 minutes (as the long clock hand is moved another 20 minutes). Children are asked how many minutes Billy accumulated (with the correct answer being 60). It is stressed that children need be able to have all their physical activity add up to at least 60 minutes (preferably each day) to develop aerobic endurance. A check for understanding may involve selecting a student to state what the accumulation time frame is for developing aerobic endurance. Further practice with the clock hands can occur during other physical education sessions. In addition, pedometers can be used throughout the year to

show the walking steps that a person is accumulating on a given day so as to reinforce the time guideline.

10. **Specificity Principle: Activities that Help Heart/Lungs Get Stronger (Gain Endurance).**
Healthy heart/lung activities are called aerobic activities and include walking biking, skating, running, swimming, and running in basketball and soccer.
Learning Idea (visual aid): Students are shown different sport or fitness magazine pictures (taped on posters) of the above activities to reinforce what physical activities make strong heart and lungs. A short experiment can also be done using a heart rate monitor to first observe the heart rate of a student playing catch and also observe the heart rate of a student who has just finished running up and down a basketball court. The rates can be compared to emphasize which activities are aerobic. An obvious check for understanding simply involves children recalling the aerobic pictures. (A video segment from a video tape such as the Slim Goodbody series can later be viewed in the classroom to show a variety of activities to develop the heart and lungs. Several web sources also can be used. Sports Illustrated for Kids (http://www.sikids.com/index.html) has cool articles/pictures about sports, and the PE4U site (http://www.pelinks4u.org/) is edited frequently and offers a focus on different sports/fitness activities.)

11. **Overload/Progression Principles for Aerobic Endurance**. Overload: A person has to increase the demands on the heart (making it work harder by playing/working more than usual) each new week to improve aerobic endurance, assuming that minimum F, I, and T variables are being met. Progression: This should be done in a slow/gradual manner (playing/working a little more than usual). This slight increase in effort may be defined by as little as one but not more than a 10% increase in the F, I, or T demands. This combined overload/progression focus for "either" the F, I or T should be done while exercising toward and eventually in the target heart rate zone. Children should be moderately to vigorously physically active everyday (but at least three days each week); and should accumulate 60 or more minutes of this physical activity each day (a minimum of 20 minutes for adolescents/adults).
Learning Idea (visual aid/object/event): The ideas suggested may occur during one or more physical education sessions. Making the heart work harder each week means that you work and play at physical activity a little more than usual. Examples of playing/working a little more than usual are displayed by: a) showing a two week calendar with 4 days checked-off for skating in the second week as compared to 3 days skating in the first week; b) having children demonstrate a slow jog followed by a slightly faster jog which would occur in week two (to cause the heart to beat a little faster). As a follow-up to the jog, the teacher may show a target heart rate zone poster with sample first and second week exercise heart rates circled; and lastly c) using the long hand of a card board clock to show how one child accumulated an average of 60 minutes of riding a bike, playing basketball, and walking for each day during a week. Then moving the long clock hand around for 65 minutes showing how they tried to do these or other physical activities a little longer in week two. As a check for understanding, selected students are then asked about how they could make their heart work harder each new week as they utilize the visual aids, objects, or a demonstration to help them. (For instance, selected students can be asked a) how much they would increase the F a little bit more while playing soccer and swimming in week two as compared to only 5 days in week one, b) for I, to demonstrate a slightly faster jump rope pace for week two (to increase heart beat) when compared to a slower one in week one, and c) for T, move the clock hand to no more than 33 minutes for walking in week two as compared to walking 30 minutes in week one.)

12. **Activities to Measure a Strong Heart/Lungs (Aerobic Endurance).** Activities that will help measure heart/lung endurance include the half mile run, mile run, a continuous shuttle run, and a nine or twelve minute run. Research suggests that it takes about two months (8-10 weeks) to see a beneficial improvement in aerobic endurance.
Learning Idea (event/visual aid): Students are reminded of the many activities that help develop healthy heart/lungs. The activity in which they will take part is selected by the teacher. Students are again reminded about pacing (and walking if needed) and the importance of trying not to stop. An emphasis is placed on improving oneself and not competing with another student. Students then practice a portion of the activity (i.e., jogging a quarter mile lap) at a comfortable pace, walking only if necessary. To check for understanding when the run is completed, selected students are asked to talk about pacing, walking, and what activities measure aerobic endurance improvement. Students may also be alerted to the idea that it takes about two months (8-10 weeks) to see a good improvement in aerobic endurance. A web site from any youth fitness test (such as Fitnessgram or the President's Challenge) can be used at a learning station or in the classroom to reinforce proper technique procedures and health-related standards. The popular PE Central web site (http://www.pecentral.org/) also provides links to several top web sites with free and commercial resources, posters, and bulletin board ideas that could be used to highlight fitness assessment.

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Authentic Teaching of Fitness Concepts to Children: Muscle Fitness Concepts

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Grades K-2

1. **The Body Has Many Muscles.** There are over 600 muscles in the following body parts: arms, legs, back, chest, and abdomen.
Learning Idea (visual aid and event): The teacher may present a poster with a drawn diagram of arm, leg, and trunk muscles (colored red). Children are then asked to feel their own arm, leg, and abdomen muscles. A check for understanding involves students pointing to body part areas that have muscles, as requested by the teacher. For a reinforcement activity, each student may be given a small version of the poster diagram to color in the muscles.

2. **The Purpose of Muscles.** Muscles are needed to move and be strong.
Learning Idea (event): Children are asked to try a modified push-up (knees on the ground). They are told that muscles allow them to move, play, work; the statement is followed by a question about what helped them do the modified push-up. The answer of course is muscles. Next they are asked to try a regular push-up and are told that strong muscles allow them to play and work harder for a longer time. As a check for understanding, the students are then asked what helped them to do the regular push-ups; the answer being strong muscles.

3. **Procedures for Lifting Objects.** In order not to hurt the muscles of the back, people should attempt a half squat or lunge-kneel position (with an erect back), using the legs to lift an object rather than the back (through bending over to lift).
Learning Idea (visual aid, object, event): The teacher introduces the correct way to lift an empty cardboard box off the ground. Then children are all asked to mimic the action by collecting bean bags in general space. To close, the teacher demonstrates and verbally reinforces correct lifting for healthy back muscles.

4. **Specificity Part 1: Exercises/Activities to Achieve Strong Muscles.** Children are presented with the idea that there are fun activities that make muscles stronger and not tire too easily. Such activities include balancing safely on body parts in gymnastics, calisthenics (such as a modified pull-up or bent knee sit-up), yard work (i.e., raking), biking, skating, climbing on playground equipment, and jumping rope.
Learning Idea (visual aid): The children are shown magazine pictures of the above activities on a poster to teach what physical activities make strong muscles. A simple check for understanding involves students recalling the pictures.

5. **Specificity Part 2: Exercises/Activities for Muscles in Different Body Parts.** It is mentioned that the fun muscles activities taught make muscles stronger in "certain" parts of the body. The arm, chest, and upper back muscles can be strengthened through climbing playground equipment, performing yard work, balancing on hands/feet in gymnastics, and doing upper body calisthenics (i.e., modified push-ups or pull-ups). Leg muscles can be strengthened through jumping rope, biking, and skating. The abdomen and lower back muscles can be strengthened by doing bent knee sit-ups or curl-ups.
Learning Idea (event and visual aid): Have selected students model the above activities (perhaps including the use of a stationary bike for convenience). Then ask which body parts are strengthened during each activity. In the classroom, pictures may be taken from magazines and newspapers to make a collage of the discussed activities. Children match the activity pictures with corresponding body parts that are strengthened. For further reinforcement in the classroom, teachers can elect to have children view a muscle development video segment from *Slim Goodbody Presents All Fit.*

6. **Correct Exercise Performance Using Own Body Weight.** Calisthenics exercises such as push-ups and bent knee sit-ups involve the use of only the body weight as a load (resistance) but should still be done correctly.
Learning Idea (event): Children are told that cheating on calisthenics exercises (push-ups, sit-ups, etc.) does not make strong muscles. A few students are then selected to show the correct technique of a regular push-up and a bent knee sit-up, followed by all children trying to do each exercise correctly. Next it is mentioned that a few good exercise repetitions are better than many repetitions that are incorrect. Teachers can utilize AAHPERD's *Physical Best Guide (Elementary Level)* to add more interesting muscle fitness learning ideas to reinforce this concept.

Grades 3-6

1. **Review K-2 Concepts**

2. **Major Muscles.** The major muscles of the body that are suggested for children to learn include the pectoralis (pects), rectus abdominus (abs or abdominals), trapezius (traps), lattissimus dorsi (lats), gluteus (glutes), biceps, triceps, deltoids (delts), quadriceps (quads), hamstrings, and gastrocnemius (gastroc).
Learning Idea (visual aid and event): As children perform the calisthenics "exercise of the day," the name of the related muscle group can be pointed out on a muscle poster with children reciting the muscle name(s). (Commercial posters such as the Bruce Alga Human Anatomy Series are available through physical education equipment catalogs.) An enjoyable game-like activity called "locotract" (created by the authors) can later be played after all major muscles have been presented over several sessions. In this activity children are asked to perform varied locomotor skill combinations in general space until a freeze signal. Whereupon, they are asked to contract (flex) the muscles called out by the teacher. Although sometimes humorous, it serves to influence the correct recall of the muscles. Later in the classroom or as homework, children can label the muscles on a diagram. In addition, an interactive science reference laboratory web page about the muscle system may be viewed (http://www.kidport.com/).

3. **Muscular Strength/Endurance Definition and Importance.** Strength means giving full force (maximum force) with muscles one time whereas muscle endurance means simply giving less than full force with muscles many times in a row; muscle fitness is needed to move, play and work well, to prevent injuries, and to feel good.
Learning Idea (object): Use a five and 10 pound weight under close teacher supervision. One student sits on a chair and raises the 10 pound hand weight in a press action over the head one time. Then another student sits on a chair and raises the five pound hand weight 15 times in a press action over the head . Next muscle strength is defined by the teacher as full muscle force to move an object one time, and muscle endurance is defined as less than full muscle force used to move an object many times in a row. Ask the two students to again demonstrate while quizzing other students about which performance is muscle strength and which is muscle endurance. Cite the importance of strength for moving a heavy object and the importance of muscle endurance for not getting too tired when moving a lighter object many times in a row. (This learning idea can also be done with two stretch bands emphasizing a maximum effort for one repetition in contrast to stretching a single band 15 times.) Also emphasize the importance of muscle fitness for feeling good, preventing injuries, playing sports well, and performing physical work. Teachers may also have students participate in station tasks that distinguish between muscular strength and muscular endurance.

4. **Specificity: Exercises/Activities for Specific Muscle Groups to Improve Muscular Strength and Endurance**. Some common activities to develop triceps, biceps, pects, delts, traps, and lats are push-up and pull-up variations, balancing with hands, transferring weight (i.e., forward roll), and resistance exercises using hand weights or stretch bands. Development of the abs can be done with curl-ups, bent knee sit-ups, and v-seat balances. Quad, glute, hamstring, and gastroc development can occur by biking, jumping rope, jumping in track or gymnastics, and also using stretch bands.
Learning Idea (visual aid and event): At stations where the above skills or exercises are performed, the name of the muscle group can be provided on a task card. [Add fun and variety to push-ups with items such as "Macarena Pushups" which is presented on the PE Central web site – (http://www.pecentral.org)]. Periodically the teacher may stop class activity to ask station groups to recite the name of the muscle group and the related exercise task.

5. **Frequency Guideline.** Frequency is defined as how often we are physically active. We should be physically active everyday; however specific muscle exercises should be performed on 2-3 alternate days each week for basic health fitness; 3-4 alternate days for increased health fitness focusing only on body weight exercises. (Daily muscle exercises are appropriate if upper/lower body exercises are performed on alternate days.)

Learning Ideas (visual aid,): The teacher presents a large calendar with alternate days checked-off to establish how often to exercise muscles during some weeks, with additional days checked-off for other weeks. It is also mentioned that we need to be physically active daily, but specific muscles should be exercised 2-3 alternate days each week to develop muscle strength and endurance. Four alternate days helps muscle fitness even more. Students can then be asked to describe a week in which there is inadequate frequency to develop strength and endurance.

6. **Intensity Guideline**. Intensity means how hard we exercise – with our own body weight as the load in doing calisthenics or using light hand weights/stretch bands as the resistance.

Learning Ideas (object and event): Intensity: As a five pound weight plate is shown to the children, the teacher explains that one's body weight is like the weight plate, and muscles develop by simply doing a calisthenics exercise because the body is the load. Students may also be shown light hand weight or stretch band equipment that is used as the load (intensity) to make muscles work hard. An opportunity may also be provided so that children can experience different exercises with the equipment. However, they should be cautioned not to use hand weights or stretch bands unless they have an expert adult to help them. (For math fun, division problems can be done in the classroom to find how many five pound weight plates correlate to each child's body weight.)

7. **Time Guideline.** Time is defined as how long we perform an exercise. This may involve seconds, minutes, or repetitions. For resistance exercise with equipment (light hand weights or stretch bands), 6-15 repetitions are recommended for 1-3 sets. Research varies on the time guideline for calisthenics, but it is appropriate for children to progress toward health-related standards specific to each exercise. Therefore, this can be accomplished with one of two strategies. First, children may be encouraged to attempt 1-15 or more repetitions of an exercise for 1-3 sets. Another way is to complete half of one's maximum repetitions of an exercise for 2-3 sets assuming that maximum repetitions of an exercise have been established (Cooper, 1991).
Learning Ideas (visual aid and event): Children are told that muscle strength and endurance can be developed simultaneously by doing as many repetitions of a calisthenics exercise as possible before tiring. However, they are reminded to try 1-15 or more repetitions of a calisthenics exercise. [A task card can be created to show this repetition goal at any exercise station. Task cards can also be designed to motivate children with different abilities, i.e., push-ups – red level (try 1-7), white level (try 8-14), blue level (try 15 or more).] For light hand weights and stretch bands, students are instructed to do no more than 15 repetitions. If a child cannot perform at least six repetitions with a hand weight, a lighter weight should be used. (A task card can also be used for hand weights/ stretch bands to show a goal of 6-15 repetitions for an exercise at a station.)

8. **Overload/Progression Principles**. Muscles need to work a little harder (a little more than usual) each new week to become stronger. This can be done by a) exercising an extra day in each new week, b) increasing the amount of the hand weight by 1-2 pounds providing 15 reps are accomplished at the previous weight, or c) adding a few more repetitions of an exercise (but only to 15 for children when using hand weights). Sets of an exercise can also be increased to two or three as a way of increasing the time variable. A basic guideline for progression of F-I-T involves a weekly improvement of 5-10%; yet with children, it would seem logical to modify the guideline to 1-10% so even small intensity/time changes may be recognized.
Learning Idea (visual aid and event): To enable an understanding of frequency overload/progression, a frequency calendar can be shown to children to depict how a day can be added during a new exercise week (up to three alternate days for light hand weights/stretch bands and up to four alternate days for body weight exercises). For intensity overload/progression, students can observe a sample exercise log in which a slightly heavier hand weight of 1-2 pounds more is to be used in a new exercise week, as a result of performing 15 repetitions at a previous weight. A sample log can also be displayed to teach time overload/progression by showing an increase of a few (i.e., 1-2) repetitions each new week to make muscles work harder. It is important for each student should keep a weekly log to observe their own improvement. Teachers are also reminded that task cards with ability ranges – red, white, and blue levels – assist student motivation. (Through demonstration/explanation in an exercise circuit, students may also be shown how the sets of an exercise can be increased to two or three while at a station or how one full circuit can be increased to two or three).

9. **Measuring Muscular Strength and Endurance**. In addition to 'developing' muscle strength and endurance, several exercises may also be used to measure the improvement in muscular strength/endurance (i.e., push-ups, modified pull-ups, pull-ups, bent knee sit-ups, and curl-ups).
Learning Ideas (event and visual aid): Children are reminded of the many activities that help develop strength and endurance for different muscle groups. Then students are selected to demonstrate the correct technique for a push-up, modified pull-up, pull-up, bent knee sit-up, and curl-up. During the demonstration, the teacher relates that some improvement can occur in a month, but it takes about 8-12 weeks (two to three months) to promote good improvement in muscle strength/endurance of a muscle group. An emphasis is placed on the challenge of improving oneself instead of competing with another student. A Fitness Goals Contract from AAHPERD's *Physical Education for Lifelong Fitness: The Physical Best Teacher's Guide* can be used to assist children to plan reasonable progress toward health-related fitness standards. [Teachers will enjoy perusing a sports medicine web site (http://sportsmedicine.about.com/cs/kids/) that has several articles on strength training for children with links to NSCA/ACSM guidelines and other research.]

(**Note:** Following the references, Table 1 will display muscle fitness guidelines promoted by selected authors and professional agencies.)

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Table 1. Selected Muscle Strength/Endurance Information for Children

	NSCA	ACSM	AAP	Physical Best	Other Research
Frequency	2-3 Non-consec. Days	2-3 Non-consec. Days	2-3 Non-consec. Days	2-3 Alt. Days (Basic); 3-4 Alt. Days (Inter.); Daily if Up./Low Body Alternated	2-3 Days
Intensity	Light Weight (Load)	Light Weight (Load)	Light Weight (Load)	Light Weight (Load)	Light Weight (Load)
Time	6-15 Reps 1-3 Sets for Major Muscle Groups Begin Program at 12-15 Reps for 1 Set with light weight	6-15 Reps 1-3 Sets for Major Muscle Groups Begin Program at 10-15 Reps for 1 Set with light weight	8-15 Reps 20-30 Minutes for All Major Muscle Groups Begin Program with No Load & Focus on Technique	6-12 Reps (basic) 6-15 Reps (inter) 1-2 Sets (basic) & 1-3 sets (inter) for Major Muscle Groups Begin Program at 6-12 Reps for 1-2 Sets (basic) with light weight	6-12 Reps 8-12 Reps 10-15 Rep 13-15 Rep 1-3 Sets for Major Muscle Groups
Overload/ Progression	5-10% Load Increments Increase Sets up to 3	5-10% Load Increments Increase Sets up to 3	Increase Load & Reps Slowly	5-10% Load Increments Increase Sets Up to 3	5-10%; also 1-2 Pound Increments; Increase Sets up to 3
		NSCA/ACSM Other professional opinion is that the age initiation of Resistance Weight Training is dependent on a child's physio-logical and psychological readiness. Then the emphasis is on correct technique and use of light resistance.		**Physical Best** The muscular strength/muscular endurance training focus in Grades K-4 should involve Body Weight Training (calisthenics)	**Kenneth Cooper** With respect to body weight training, the following is recommended for reps per set: First, count max. reps stressing correct form. Use half of max. as rep total. Then do 2-3 sets with 30 second rest periods.

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